SPECIFICATION

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METHODS AND APPARATUS FOR AUTOMATICALLY TRANSFERRING ELECTRICAL POWER

Background of Invention

[0001] This invention relates generally to electrical power transfer and, more particularly, to automatic transfer switches.

[0002] An automatic transfer switch provides a continuous source of power for critical loads by automatically transferring from a normal power source to an emergency power source when the normal power source falls below a preset limit. Automatic transfer switches are in widespread use in hospitals, military installations, industrial sites, and commercial buildings where even brief power interruptions can be costly. Automatic transfer switches are also common to the power industry. Typical automatic transfer switches include a plurality of mechanical switching components controlled to minimize any interruptions during switching operations. Control of the switching components occurs through a series of sensing relays, transformers, and actuators, such as solenoids or linear motors to facilitate timely transfer from normal to emergency power. The solenoid actuators are energized until the controller senses that the switching component has moved to its desired position. Typically, a plurality of limit switches are positioned to provide a signal to the controller that switching is complete. Proper alignment of the limit switches facilitates a longer lasting automatic transfer switch because when the solenoid is energized, but the limit switch fails to actuate because of misalignment, the solenoid will be energized for a prolonged period of time which may damage the

solenoid. Additionally, the limit switches, typically, are adjusted during assembly and/or installation resulting in an expenditure of time and raising assembly and/or installation costs.

[0003] Accordingly, it would be desirable to provide a cost-effective automatic transfer switch that is easy to assemble and install and facilitates a proper alignment of the limit switches and the switching components without adjustment during assembly and installation.

Summary of Invention

[0004] An automatic transfer switch includes a main body having a solenoid side and an auxiliary side. A solenoid side limit switch assembly is mounted to the solenoid side and an auxiliary side limit switch assembly is mounted on the auxiliary side. The solenoid side limit switch assembly includes a plurality of limit switches and a solenoid side mounting plate. The auxiliary side limit switch assembly includes a plurality of limit switches and an auxiliary side mounting plate. A unitary arc chute cover plate covers a plurality of phase plates.

[0005] The limit switches are in fixed relationship to the mounting plates and assembly time is decreased because the limit switches are not adjusted during assembly. Additionally the unitary construction of the arc chute cover plate facilitates a reduction in assembly time versus an automatic transfer switch having a plurality of separate cover plates. The automatic transfer switch facilitates a decrease in assembly time by utilizing a pre-assembled auxiliary limit switch assembly, a pre-assembled solenoid side limit switch assembly, and a unitary construction. The limit switches are not adjusted during assembly and installation providing for easy assembly and installation. Additionally, a tabbed mounting plate provides for easy mounting of the automatic transfer switch to an enclosure facilitating a decrease in installation time. Accordingly, an easy to assemble and install automatic transfer switch that is cost-effective is provided.

Brief Description of Drawings

[0006] Figure 1 is a perspective view of one embodiment of an automatic transfer

switch.

[0007] Figure 2 is a perspective view of the automatic transfer switch shown in Figure 1.

[0008] Figure 3 is a partially exploded view of the automatic transfer switch shown in Figure 1.

[0009] Figure 4 is an exploded view of a solenoid side limit switch assembly shown in Figures 1.

[0010] Figure 5 is a top view of the automatic transfer switch shown in Figure 1 mounted on a tabbed mounting plate.

[0011] Figure 6 is a side view of the automatic transfer switch shown in Figure 1 mounted on the tabbed mounting plate shown in Figure 5.

[0012] Figure 7 is a partially exploded view of the automatic transfer switch shown in Figure 1.

Detailed Description

[0013] Figure 1 is a perspective view of one embodiment of an automatic transfer switch 10 including a solenoid side 12 and Figure 2 is a perspective view of transfer switch 10 illustrating an auxiliary side 14 of transfer switch 10. Transfer switch 10 is mounted to a mounting plate 16 and includes a main body 17 including a plurality of bus assemblies 18 electrically connected to a plurality of phase plates 20. Mounting plate 16 includes a plurality of mounting depressions 19 each including a mounting opening 21 substantially centered therein. Mounting depressions 19 are generally semispherically shaped. On solenoid side 12, transfer switch 10 includes a solenoid 22 and a solenoid side limit switch assembly 24. On auxiliary side 14, transfer switch 10 includes an auxiliary side limit switch assembly 26.

[0014] Figure 3 is a partially exploded view of transfer switch 10. Auxiliary side limit switch assembly 26 includes a plurality of limit switches 28 interspersed with a

plurality of spacers 30. In an exemplary embodiment, auxiliary side limit switch assembly includes ten limit switches 28, twelve spacers 30, an auxiliary side mounting plate 32, and an auxiliary side end plate 34. In an exemplary embodiment, spacers 30 are fabricated from a flame resistant polypropylene, such as, for example, 30,000 Formax, commercially available from Absolute Industrial Fabricators, Adison Il. Limit switches 28 are oriented substantially perpendicular to mounting plate 16 and are arranged in coplanar pairs with three pairs internal to main body 17 and two pairs external to main body 17. In an exemplary embodiment, auxiliary side mounting plate 32 is fabricated from nickel-plated 1/8 inch thick cold rolled steel and auxiliary side end plate 34 is fabricated from .052 inch thick galvanized steel.

[0015] During assembly of transfer switch 10, auxiliary side limit switch assembly 26 is assembled and mounted to transfer switch 10 utilizing auxiliary side mounting plate 32. Each switch 28 includes a plurality of mounting openings 36. Inserting a plurality of mounting rods 38 through end plate 34, spacers 30, switches 28, and auxiliary side mounting plate 32 positions switches 28 in a fixed relationship with auxiliary side mounting plate 32 which facilitates assembly of transfer switch 10 without adjustment of switches 28. The fixed relationship of switches 28 with mounting plate 32 also facilitates a perpendicular orientation of switches 28 to mounting plate 16. In an exemplary embodiment, mounting rods 38 are threaded and threadably engage transfer switch 10.

[0016] Figure 4 is an exploded view of solenoid side limit switch assembly 24 (shown in Figures 1-3) including a plurality of limit switches 50 interspersed with a plurality of spacers 52. In one embodiment, solenoid side limit switch assembly 24 includes four limit switches 50, six spacers 52, a solenoid side mounting plate 54, and a manual switch knob 56. Limit switches 50 are oriented substantially perpendicular to mounting plate 16 and are arranged in coplanar pairs external to main body 17.

[0017] During assembly of transfer switch 10, solenoid side limit switch assembly 24 is assembled and mounted to transfer switch 10 utilizing solenoid side mounting

plate 54. Each switch 50 includes a plurality of mounting openings 58. Inserting a plurality of mounting rods 60 through spacers 52, switches 50, and solenoid side mounting plate 54 positions switches 50 in a fixed relationship with solenoid side mounting plate 54 which facilitates assembly of transfer switch 10 without adjustment of switches 50. The fixed relationship of switches 50 with solenoid side mounting plate 54 also facilitates a perpendicular orientation of switches 50 to mounting plate 16. In one exemplary embodiment, mounting rods 60 are threaded and threadably engage transfer switch 10. In an alternative exemplary embodiment, transfer switch 10 is molded and includes a unitary molded pocket sized to receive solenoid side mounting plate 54 which decreases assembly time and facilitates a perpendicular alignment between switches 50 and mounting plate 16. In a further alternative embodiment, transfer switch 10 includes a plurality of unitarily molded pockets to accept solenoid 22 and other accessories. Auxiliary side limit switch assembly 26 and solenoid side limit switch assembly 24 are mounted separately to mounting plate 16 prior to main body 17 being mounted to mounting plate 16.

[0018] During operation, transfer switch 10 provides a continuous source of power for critical loads by automatically transferring from a normal power source to an emergency power source when the normal power source falls below preset limits. Transfer switch 10 is rated for between 30 amperes and 225 amperes.

[0019] Figure 5 is a top view and Figure 6 is a side view of transfer switch 10 (shown in Figures 1-4) mounted on a tabbed mounting plate 70 including a plurality of attachment tabs 72 extending from tabbed mounting plate 70. Each attachment tab 72 is unitary with tabbed mounting plate 70 and each tab 72 extends obliquely from a first bend 74. Each tab 72 includes a second bend 76 after which each attachment tab 72 extends substantially parallel to tabbed mounting plate 70 defining a width 77 corresponding to a width of an enclosure (not shown). In one embodiment, mounting plate 70 is fabricated from sheet steel and attachment tabs 72 are formed with a punch press in a single operation. In an alternative embodiment, attachment tabs 72 are not unitary with tabbed mounting plate 70. Rather, attachment tabs 72 are fabricated separate from tabbed mounting plate 70

and are attached according to conventional methods. The enclosure includes a plurality of debossed tabs sized and positioned to receive attachment tabs 72. In an exemplary embodiment, each attachment tab 72 includes at least one mounting opening 78 substantially centered thereon to facilitate attaching tabbed mounting plate 70 to an enclosure having mounting studs instead of debossed tabs. Tabbed mounting plate 70 can be mounted to an enclosure having embossed tabs utilizing width 77 of attachment tabs 72 and can be mounted to an enclosure without debossed tabs utilizing mounting openings 78 of attachment tabs 72. Accordingly, tabbed mounting plate 70 provides for dual mounting capabilities. Attachment tabs 72 are disposed symmetric with respect to a first line of symmetry 80 and are symmetric with respect to a second line of symmetry 82 orthogonal to first line of symmetry 80. Attachment tabs 72 include a leading edge 84 positioned between two tapered edges 86 that extend to two side edges 88.

[0020] Figure 7 is a partially exploded view of transfer switch 10 including a removable arc chute cover plate 90 including a plurality of mounting openings 92. Arc chute cover plate 90 is a unitary piece of non-conductive material utilized to cover phase plates 20. In an exemplary embodiment, cover plate is molded from a thermoset plastic i.e., a plastic such that when heat is applied, the plastic softens and then hardens (sets) as the plastic cools wherein the plastic can not be softened again.

[0021] During assembly of transfer switch 10, the unitary construction of arc chute cover plate 90 facilitates a reduction in assembly time versus an automatic transfer switch having a plurality of separate cover plates. Transfer switch 10 facilitates a decrease in assembly time by utilizing a pre-assembled auxiliary limit switch assembly, a pre-assembled solenoid side limit switch assembly, and a unitary construction. The limit switches are not adjusted during assembly and installation providing for easy assembly and installation. Additionally, tabbed mounting plate provides for easy mounting of transfer switch 10 to an enclosure facilitating a decrease in installation time.

[0022] While the invention has been described in terms of various specific

embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.